

City of Santa Barbara Creeks Division

Water Quality Monitoring

FY11 RESEARCH PLAN

The goals of the monitoring program are to:

1. Quantify the levels (concentration and flux, or load) of microbial contamination and chemical pollution in watersheds throughout the city.
2. Evaluate impacts of pollution on beneficial uses of creeks and beaches, including recreation and habitat for aquatic organisms.
3. Evaluate the effectiveness of the City's restoration and water quality treatment projects, which includes collecting baseline data for future projects.
4. Identify sources of contaminants and pollution in creeks and storm drains.
5. Evaluate long-term trends in water quality.

The underlying motivation behind the monitoring program is to obtain information that the City can use to:

1. Develop strategies for water quality improvement, including prioritization of capital projects and outreach/education programs.
2. Communicate effectively with the public about water quality.

PROGRAM ELEMENTS AND QUESTIONS

A. Watershed Assessment

Research questions:

1. Is overall water quality, in terms of indicator bacteria and field properties, getting better over time?
2. How contaminated and/or toxic is sediment at creek sites, particularly those below storm drain outfalls?
3. What is the impact of eutrophication on Santa Barbara creeks?
4. What is the impact of recycled water on water quality, including irrigation runoff and water line breaks?
5. What is the impact of groundwater pumping (sump discharge to storm drain) on water quality?
6. What is the source of the 303(d) impairment for Salinity on Sycamore Creek?
7. What is the source of the 303(d) impairment for Unknown Toxicity on Mission Creek?

B. Storm Monitoring

Research Questions:

1. What are the highest concentrations of pollutants of concern during storm events, particularly seasonal first flush storms?
Do creeks and/or storm drains in Santa Barbara have problems with toxicity during storm events?
2. What are the loads of pollutants discharged from Santa Barbara creeks during storms?
3. What are the sources of toxicity and routes of pollutants to storm drains during storms?
4. How do concentrations and loads vary during storms and from site to site?
 - o Fecal indicator bacteria
 - o Slurry seal/PAHs/Foam
 - o Metals
 - o Nutrients
5. How do restoration/treatment projects impact water quality and restoration during storm events, including fish passages, the parking lot retrofit project, the Upper Las Positas Stormwater Management Project (Golf Course), and post-construction BMP assessment?

C. Restoration and Water Quality Project Assessment

The Creeks Division has completed several restoration and water quality improvement capital projects over the past several years. Project assessment is used to determine the success of projects in lowering microbial and chemical pollution levels and improving water quality for aquatic organisms. In some cases project monitoring is grant-required, and the remaining is for internal review of project success. Additional monitoring is conducted to ensure that the facility is performing as intended.

Research Questions:

1. Do Creeks Division projects result in improved water quality, as reflected in pre- and post-project, and/or, upstream to downstream, conditions?
2. What is the baseline water quality at future restoration/treatment sites?
3. What are the mechanisms of project success?

4. Are installed projects functioning correctly?

List of Projects

1. Westside SURF and Old Mission Creek Restoration.
2. Arroyo Burro Restoration, including Mesa Creek daylighting.
3. Hope and Haley Diversions.
4. Mission Lagoon Restoration and dLaguna Channel Disinfection
5. Golf Course Project (Storm)
6. San Pascual Drain (Source Tracking)
7. Parking Lot LID Retrofit (Storm)
8. Debris Screens (Creek Walks)
9. Mission Creek Fish Passage (Eutrophication/Dissolved Oxygen)
10. Bird Refuge

D. Beach water quality

Research questions:

1. How do creeks and storm drains relate to beach water quality and warnings?
2. How do other factors (kelp, tides, temperature, and beach use) relate to beach warnings?
3. What are the causes of persistent beach warnings that occur?
4. What is the risk to human health from recreation in creeks and beaches in Santa Barbara?

E. Source Tracking/Illicit Discharge Detection

Research questions:

1. Which subdrainages and/or contribute the greatest loads of pollutants to creeks in Santa Barbara? (CBI).
2. Where, when and how is human waste and/or sewage entering storm drains and creeks?
 - a. What happens to the signals of human waste and indicator bacteria levels as water moves downstream away from the source?
 - b. How does presence of human waste relate to beach warnings?
3. Do rotting plant material and sediment contribute to high FIB levels in storm drains?
4. What are the impacts of reservoir flushing on metals?
5. Are new hot spots emerging?
6. Specific areas of concern: Barger Canyon, Las Positas Creek, Haley Drain

F. Creeks Walks/Clean ups

Research Questions:

1. Are there new problems in creeks that need to be addressed?
2. Is the amount of trash in creeks decreasing over time?
3. Were decreases in trash observed between 1999 and 2005 due to creek flow histories or the impact of City programs?
4. Will the installation of catch basin screens lead to decreased trash observed in creeks?
5. Can we see any impairment to San Roque Creek, leading to drop in bioassessment scores?

G. Bioassessment

The biological assessment element is used to assess and monitor the biological integrity of local creeks as they respond through time to natural and human influences.

Research Questions:

1. What is the baseline of biological integrity for benthic macroinvertebrates in creeks?
2. Are there differences between upper watershed and lower watershed sites?
3. Are there differences among watersheds?
4. How does the biological integrity in our creeks change over time?
5. How does the biological integrity respond to water quality and restoration projects?

H. Methods Development

1. Can we use the following potential new tools?
 - a. Can a chemical fingerprint be used to identify types of sources?
 - b. Can field kits be used for enforcement?

DRAFT – PENDING COST ESTIMATES FROM LABORATORY BIDS

PROGRAM ELEMENT and QUESTIONS	CONSTITUENTS/METHODS	SITES	FREQUENCY
A. Watershed Assessment			
1. Is overall water quality, in terms of indicator bacteria and field properties, getting better over time?	FIB, field parameters, flow	Integrator Sites Honda and Lighthouse	Biweekly (26 x 4) Quarterly (4 x 2)
2. How contaminated and/or toxic is sediment at creek sites?	Metals, PAHs, Toxicity, Pyrethroids	8 creeks sites TBD	Yearly, in late summer
3. What is the impact of eutrophication on Santa Barbara creeks?	Nutrients, DO, Bioassessment, Algae cover	TBD 20 nutrient suites	Weekly to Monthly
4. What is the impact of groundwater pumping?	Semivolatile organics	TBD 4 sump pump discharges located near LUST sites	
5. What is the impact of recycled water on water quality?	Salinity and PPCPs	2 discharges and 4 creek sites.	One time.
6. What is the source of the impairment for Salinity on Sycamore Creek?	Salinity	Creek walk	Monthly
7. What is the source of the impairment for toxicity on Mission Creek?	Toxicity Tests, especially algae	Quarterly sampling sites plus Mission Canyon	Quarterly (3x's during dry weather)
B. Storm Monitoring			
1. What are the highest concentrations of pollutants of concern during storm events, particularly seasonal first flush storms, in creeks? Do storm drains in Santa Barbara have problems with toxicity during storm events?	Metals, Herbicides, Pesticides, Nutrients, Hydrocarbons, MBAS, Toxicity (Vert, invert, algae)	Integrator Sites and eight storm drains, full suite on all	Yearly, first flush. Collect creek samples early during runoff event. Collect drain samples second.
2. What are the loads of pollutants discharged from Santa Barbara creeks during storms?	Metals, MBAS, FIB	Arroyo Burro at Cliff (location of flow gauge and autosampler)	Conduct composite sampling according to Caltrans (2008) during a 1" forecasted storm.
3. What are the sources and routes of pollutants during storms?	Fecal indicator bacteria, Sediment, MBAS (or cationic surfactants), PAHs. Visual observation for foam during storm event.	Arroyo Burro at Cliff Simulated rain and runoff from recently sealed parking lots and/or streets.	Conduct composite sampling according to Caltrans (2008) during a 1" forecasted storm.
4. Slurry seal	PAHs, toxicity	8 sites	One early storm
5. How do restoration/treatment	Bacteria, nutrients, metals, sediment	Seven sites at Golf Course	Three storms for Golf Course.

PROGRAM ELEMENT and QUESTIONS	CONSTITUENTS/METHODS	SITES	FREQUENCY
projects impact water quality during storm events?	Rainfall, Flow, Two sites for full storm suite. Post-construction BMP Fish passages	MacKenzie park TBD Flow rate	First flush One later storm. Several storms of varying intensities.
C. Restoration and Water Quality Project Assessment			
1. Westside SURF and Old Mission Creek Restoration (see annual report for details)	Indicator bacteria and field parameters.	SURF up, SURF down, Westside Drain, OMC at W. Anapamu, 10 sites between Westside Drain and W. Anapamu	Weekly for SURF operation, biweekly for downstream impacts, and quarterly for regrowth study
2. Arroyo Burro Restoration, including Mesa Creek daylighting (Suspension of quarterly testing until results from biweekly testing warrant a change).	Indicator bacteria and field parameters	AB at Cliff, Mesa upper, Mesa lower, AB Estuary upper, AB Estuary Mouth, AB Surf	Biweekly
3. Hope and Haley Diversions	Indicator bacteria and field parameters	Hope Diversions, Haley Pump	Biannual
4. Laguna Channel Disinfection (Source Tracking)	Indicator bacteria and field parameters	Laguna at Chase Palm (already covered by routine)	Biweekly
5. Golf Course Project (Storm)	See storm monitoring. Also sample discharge for management information. DO, Temp, Nutrients, Sediment, Chlorophylla	See storm monitoring. East basin discharge.	Biweekly.
6. Parking Lot LID (Storm)	See storm monitoring		
7. Debris Screens (Creek Walks)	See creek walks		
8. Mission Creek Fish Passage (Eutrophication/Dissolved Oxygen)	Dissolved Oxygen, pH, temperature, conductivity (nutrients as part of above study)	MC Lagoon, MC upper reaches	Install probes for summer months, collect data continuously
9. Bird Refuge	Indicator bacteria, chlorophyll a, nutrients, and field parameters ON HOLD	Bird Refuge Inflow, Landing and Outlet	Monthly
D. Beach water quality			
1. Is growth on sediment and/or kelp responsible for beach warnings?	Sample plan to be determined. FIB only.		
2. What are the causes of persistent beach warnings that occur?	Conduct additional surveillance and sampling (indicator bacteria and/or DNA techniques) up creek and within estuaries when persistent warnings occur.		
3. What is the risk to human health from recreation in creeks and beaches in Santa Barbara?	Use forthcoming epidemiology studies in Southern California to conduct simple model of illness rates at Santa Barbara beaches.		

PROGRAM ELEMENT and QUESTIONS	CONSTITUENTS/METHODS	SITES	FREQUENCY
E. Source Tracking/Illicit Discharge Detection			
1. Which subdrainages and/or contribute the greatest loads of pollutants to creeks in Santa Barbara? (CBI)	Source Tracking Grant		
2. Where, when and how is human waste and/or sewage entering storm drains and creeks?	Source Tracking Grant		
3. What happens to the signals of human waste and indicator bacteria levels as water moves downstream away from the source?	Source Tracking Grant		
4. How does presence of human waste relate to beach warnings?	Source Tracking Grant		
5. Do rotting plant material and sediment contribute to high FIB levels in storm drains?	Work with Streets Division to conduct pilot study on catch basin and storm drain cleaning on indicator bacteria levels. And TSS.	Possible site: Montecito St. in Laguna Channel Watershed. Ideal sites are located at terminal upstream end of storm drain, with easy access for cleaning and sampling.	Monthly.
6. What are the impacts of reservoir flushing on metals?	Metals, sediment.	Rattlesnake Creek and Reservoir outlet.	Single event.
7. Are new hot spots emerging?	Observation, enforcement.	Serena Drain and others	
F. Creeks Walks/Clean ups			
1. Are there new problems in creeks that need to be addressed?	Creek clean ups		
2. Is the amount of trash in creeks decreasing over time?	Weight of trash removed each year.		
3. Were decreases in trash observed between 1999 and 2005 due to creek flow histories or the impact of City programs?	Continue measuring and marking GPS coordinates of trash in Old Mission Creek and Lower Mission Creek (Oak Park to beach).		
4. Will the installation of catch basin screens lead to decreased trash observed in creeks?	See 3.		

PROGRAM ELEMENT and QUESTIONS	CONSTITUENTS/METHODS	SITES	FREQUENCY
G. Bioassessment	See Bioassessment Proposal and Reports.		
H. Methods Development			
1. Can a chemical fingerprint be used to identify types of sources?	No sampling, just data analysis.		
2. Investigate field screening kits.	Investigate costs and options.		